

We Claim:

1. A method of forming a toughened article comprising the steps of:
  - 5 (a) forming a solids blend comprising a thermoplastic polymer and a comb copolymer;
  - (b) heating and mixing said solids blend to form a melt blend; and
  - (c) shaping said melt blend to form an article;  
wherein said comb copolymer comprises:
    - 10 a backbone; and
    - as polymerized units, at least one macromonomer comprising a graft segment; and

wherein said macromonomer is a macromonomer produced by aqueous emulsion polymerization.
- 15 2. The method of claim 1, further comprising the step:
  - (d) cooling said article to room temperature.
3. The method of claim 1, wherein said comb copolymer is present in an amount sufficient that said article has an impact resistance energy increased at least 15 percent compared to a second article formed identically, absent said comb copolymer.
- 20 4. The method of claim 1, wherein said thermoplastic polymer is a polymer selected from the group consisting of poly(vinyl halide), ABS terpolymer, poly(styrene-acrylonitrile), poly(styrene-acrylonitrile-acrylate), polyaromatics, poly(vinyl acetate), poly(vinyl methyl ether), chlorinated polyethylene, phenoxy (polyhydroxypropylether of bisphenol A), poly(methyl methacrylate), poly(styrene-maleic anhydride), poly(ethylene-vinyl acetate), polyesters, polyamides, polyacetal, polyurethane, polyolefins, polycarbonate, and combinations thereof.
- 25 5. The method of claim 1, wherein said thermoplastic polymer is poly(vinyl chloride).

6. The method of claim 1, wherein said backbone is immiscible with said thermoplastic polymer.

7. The method of claim 1, wherein said graft segment has a degree of polymerization of 10 to 1,000.

5 8. The method of claim 1, wherein said graft segment and said backbone are in a weight ratio of 10:90 to 60:40.

9. A method of forming a toughened article wherein said method comprises the steps of:

(A) forming a macromonomer aqueous emulsion comprising a plurality of 10 water-insoluble particles of macromonomer, wherein:

(i) said macromonomer comprises polymerized units of at least one first ethylenically unsaturated monomer;

(ii) said macromonomer is produced by aqueous emulsion polymerization; and

15 (iii) said macromonomer further has:

(a) a degree of polymerization of from 10 to 1000; and

(b) at least one terminal ethylenically unsaturated group;

(B) forming a monomer composition comprising at least one second ethylenically unsaturated monomer;

20 (C) combining at least a portion of said macromonomer aqueous emulsion and at least a portion of said monomer composition to form a polymerization reaction mixture;

(D) polymerizing said macromonomer with said second ethylenically unsaturated monomer in the presence of an initiator to produce said 25 plurality of comb copolymer particles;

(E) isolating said comb copolymer particles to form a solid comb copolymer;

(F) forming a solids blend comprising a thermoplastic polymer and said solid comb copolymer;

(G) heating and mixing said solids blend to form a melt blend; and

30 (H) shaping said melt blend to form said article.

10. The method of claim 9, further comprising the step:

(I) cooling said article to room temperature.

11. The method of claim 9, wherein said comb copolymer is present in an amount sufficient that said article has an impact resistance energy increased at least 15 percent compared to a second article formed identically, absent said comb copolymer.

12. The method of claim 9, wherein said thermoplastic polymer is a polymer selected from the group consisting of poly(vinyl halide), ABS terpolymer, poly(styrene-acrylonitrile), poly(styrene-acrylonitrile-acrylate), polyaromatics, poly(vinyl acetate), poly(vinyl methyl ether), chlorinated polyethylene, phenoxy (polyhydroxypropylether of bisphenol A), poly(methyl methacrylate), poly(styrene-maleic anhydride), poly(ethylene-vinyl acetate), polyesters, polyamides, polyacetal, polyurethane, polyolefins, polycarbonate, and combinations thereof.

13. The method of claim 9, wherein said thermoplastic polymer is poly(vinyl chloride).

14. The method of claim 9, wherein said backbone is immiscible with said thermoplastic polymer.

15. The method of claim 9, wherein said graft segment is miscible with said thermoplastic polymer.

20. 16. The method of claim 9, wherein said graft segment has a degree of polymerization of 10 to 1,000.

17. The method of claim 9, wherein said backbone has a glass transition temperature of -80°C to 0°C.

25. 18. The method of claim 9, wherein said graft segment has a glass transition temperature of 50°C to 180°C.

19. The method of claim 9, wherein said graft segment and said backbone are in a weight ratio of 10:90 to 60:40.

20. The method of claim 9, wherein said comb copolymer is present at 2 to 40 parts by weight per 100 parts by weight of said thermoplastic polymer.